

# Deep water circulation around the Iberian continental margin: state of art and future implications

Estefania Llave<sup>1</sup>, Francisco J. Hernández-Molina<sup>2</sup>, Gemma Ercilla<sup>3</sup>, Cristina Roque<sup>4</sup>, David Van Rooij<sup>5</sup>, Marga García<sup>6</sup>, Rachel E. Brackenridge<sup>7</sup>, Carmen Juan<sup>3</sup>, Anxo Mena<sup>8</sup>, Gloria Jané<sup>1</sup> and Dorrik A.V. Stow<sup>7</sup>

- 1 IGME, Ríos Rosas 23, 28003 Madrid, Spain. ([e.llave@igme.es](mailto:e.llave@igme.es))
- 2 Dept. Earth Sciences, Royal Holloway U. of London, Egham, TW20 0EX, UK.
- 3 CSIC, CMIMA, Paseo Marítimo Barceloneta, 37-49, 08003 Barcelona, Spain.
- 4 Divisão de Geologia e Georecursos Marinhos, IPMA, Lisboa, Portugal.
- 5 Renard Centre of Marine Geology (RCMG), Ghent University, Krijgslaan 281 S8, B-9000 Gent, Belgium.
- 6 IACT (CSIC-Univ. Granada), Avda. de las Palmeras, 4, 18100 Armilla (Granada), Spain.
- 7 IPE, Heriot-Watt Univ., Edinburgh EH14 4AS, Scotland, UK.
- 8 Dpto. de Xeociencias Mariñas e O.T., U. de Vigo. E-36310 Vigo (Pontevedra), Spain.

**Abstract:** Numerous and frequent examples of deep water bottom-current processes and products have been recorded in the recent evolution of the Iberian margins, comprising both erosive (terraces, abraded surfaces, channels, furrows and moats) and depositional (separated, sheeted, plastered and confined drifts) features of variable dimensions, depending on a variety of geological and oceanographic contexts. Most of them are related to the influence of the Mediterranean water masses, especially by the interaction of the Mediterranean Outflow Water with the seafloor. Despite their important scientific implications (stratigraphy, sedimentology, paleoceanography, paleoclimatology), geological hazards and economic potential, there is no full knowledge about the specific morphologic details of these features and its evolution as well as their relation with water masses and associated interphases. So, future multidisciplinary work has to be done between geologist and oceanographers for understanding the bottom current influence along the Iberian margin.

**Key words:** Contourites, Iberian margin, bottom currents, sedimentary processes, control factors

## INTRODUCTION

The Iberian margins lie under the influence of several water masses interacting along the upper and middle continental slopes and, although in minor intensity, also under the lower slope and abyssal plains. In all these domains, extensive, complex and often poorly known contourite features of large dimensions and diverse sediment thickness are occurring in different geologic contexts. These features are mainly formed under the influence of the Mediterranean water masses, especially by the interaction of the Mediterranean Outflow Water (MOW) with the seafloor (Hernandez-Molina et al., 2011).

## MAIN CONTOURITE EXAMPLES AROUND IBERIA

Several water masses are interacting along the upper and middle continental slopes and, although in minor intensity, also on the lower slope and abyssal plains around Iberia, developing main drifts or Contourite Depositional Systems (CDSs): SW Ceuta CDS Alboran Sea (Ercilla et al., 2002), in the Gulf of Cadiz (the most studied so far, Roque et al., 2012; Brackenridge et al., 2013; Hernandez-Molina et al., 2014; among others), western margin off Portugal (Pereira and Alves, 2011), in the Galician margin (Ercilla et al., 2011); in the Ortegal Spur, and in Le Danois Bank or "Cachucho" (Hernandez-Molina et al., 2011). These are mainly muddy separated, sheeted, plastered and confined drift. Described erosive

contourite features comprise terraces, abraded surfaces, channels, furrows and moats. All of them are mainly generated by the Mediterranean water masses along the Iberian margin, especially formed under the influence of the Mediterranean Outflow Water (MOW) with the seafloor (Fig. 1). Their genesis and facies models are still not fully established, despite its enormous potential for the location of hydrocarbons and mineral resources (Stow et al., 2011).

## DISCUSSION: CONTROL FACTORS AND IMPLICATIONS

In the development of both depositional and erosional contourite features more controlling factors than only the bottom-current velocity have to be taken into account, including: *Local margin morphology* particularly inherited of geological features, facilitate local water mass interaction with the seabed. During the Pliocene and lower Quaternary, tectonics have represented a long-term factor, conditioning the drift stratigraphy, architectural changes and the location of large-scale contourite features; *Sediment supply*, by possible multitude of sources, each with a time-variable aspect; *Pycnoclines* interaction with the seafloor, internal waves, and its implications with *glacioeustatic changes*, which significant influence in the outbuilding of contourites features ate the Iberian margin, especially during the Quaternary.

Contouritic sediments are generally fairly continuous and yield relatively high-temporal

resolution records, due to the enhanced accumulation rates within contourite drifts. Therefore, these sediments hold the key for valuable information on the variability in ocean circulation patterns, current velocities, oceanographic history and basin interconnectivity. Besides, submarine slope instability is commonly related to the distribution, composition and physical properties of contourites. On the other hand, fine-grained contourites, related to both sealing facies/permeability barriers and source-rock accumulation play an important role in the characterization of deep-water petroleum systems.

The role of bottom currents circulation in shaping the seafloor and controlling the sedimentary stacking pattern on the Iberian continental margins has noticeable increased during the last 20 years, although the work for a better define diagnostic criteria in contourite features identification and facies models is far from being finished. Despite their important scientific implications (stratigraphy, sedimentology, paleoceanography, paleoclimatology), geological hazards and economic potential for its potential mineral and energy resources, the conceptual models associated with these features and contouritic deposits along the Iberian margin are still pending to be proposed, there is no full knowledge about the different oceanographic processes which could drive bottom currents and also there is the need to document the big variety of contourite features and facies models, their evolution over time and space. A future advance both in new technologies and integrated studies (geology, oceanography and benthic biology) is expected.

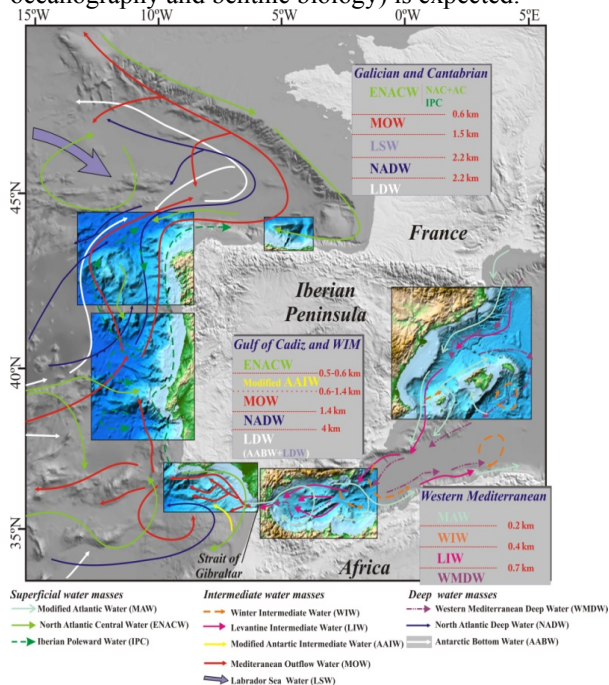


FIGURE 1. Surficial, intermediate and deep-water circulation around the Iberian Continental Margin. (Modified from Hernández-Molina et al., 2011) and location of the studied areas.

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